

WEIGHTED DECISION MAKING SYSTEMS, METHODS AND COMPUTER PROGRAM PRODUCTS

Cross-Reference to Provisional Application

5 This application claims the benefit of Provisional Application Serial No. 60/445,655, entitled *Weighted Decision Making System*, filed February 6, 2003, assigned to the assignee of the present invention, the disclosure of which is hereby incorporated herein by reference in its entirety as if set forth fully herein.

Field of the Application

10 This invention relates to computer systems, methods and computer program products, and more particularly to computer-based decision making systems, methods and computer program products.

Background of the Invention

15 Each of us is faced with numerous decision making opportunities each day. The decision making process is often more subjective than objective. Numerous factors contribute to our final solution. Illogical mental trade-offs are often made to arrive at a final decision. This final decision may or may not be the best selection for
20 the person.

Summary of the Invention

 Computer-based decision making methods according to some embodiments of the present invention may be used to select a choice from a plurality of choices. A set
25 of criteria that pertain to the plurality of choices is displayed to a user. User selection of at least a subset of the criteria is accepted. User inputs are accepted of weights of the criteria that were selected. User inputs are then accepted of a numeric rating of the criteria that were selected, for each of the plurality of choices. A score is calculated for each choice by summing the products of numeric rating and the weight
30 for the criteria that were selected. Finally, at least one of the choices is displayed based on the scores that were calculated.

 In some embodiments, when accepting user input of weights, different

interpretations that a selected criterion may have are displayed to the user. User input is then accepted as to a desired interpretation for the selected criterion. In other embodiments, the weights are scaled. In still other embodiments, when the set of criteria are displayed, they are arranged in groups. According to yet other
5 embodiments, the choices may be displayed based on the scores that were calculated, by displaying a ranking of the plurality of choices based on the scores. Finally, in still other embodiments, the selected criteria, weights and/or scores for a plurality of users are analyzed.

It will be understood that embodiments of the invention have been described
10 above primarily with respect to method aspects. However, related systems and computer program products also may be provided according to embodiments of the present invention.

Brief Description of the Drawings

15 Figure 1 is a flowchart of overall operations that may be performed by weighted decision making systems, methods and computer program products, according to some embodiments of the present invention.

Figure 2 is a flowchart of operations that may be performed to accept user selection of criteria, weights and interpretations of criteria, according to some
20 embodiments of the present invention, in order to build a database of criteria and weights.

Figure 3 is a flowchart of operations that may be performed to accept user inputs of ratings for the plurality of choices, to calculate scores and to display and/or analyze the results, according to some embodiments of the present invention.

25 Figure 4 is a functional block diagram that illustrates interaction of various functions, according to some embodiments of the present invention.

Figures 5-15 are exemplary display screens that may be used in some embodiments of the present invention.

Detailed Description

30 The present invention now will be described more fully hereinafter with reference to the accompanying figures, in which embodiments of the invention are

shown. This invention may, however, be embodied in many alternate forms and should not be construed as limited to the embodiments set forth herein.

Accordingly, while the invention is susceptible to various modifications and alternative forms, specific embodiments thereof are shown by way of example in the
5 drawings and will herein be described in detail. It should be understood, however, that there is no intent to limit the invention to the particular forms disclosed, but on the contrary, the invention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the invention as defined by the claims.

The present invention is described below with reference to block diagrams
10 and/or flowchart illustrations of methods, apparatus (systems) and/or computer program products according to embodiments of the invention. It is understood that a block of the block diagrams and/or flowchart illustrations, and combinations of blocks in the block diagrams and/or flowchart illustrations, can be implemented by computer program instructions. These computer program instructions may be provided to a
15 processor of a general purpose computer, special purpose computer, and/or other programmable data processing apparatus to produce a machine, such that the instructions, which execute via the processor of the computer and/or other programmable data processing apparatus, create means for implementing the functions/acts specified in the block diagrams and/or flowchart block or blocks.

20 These computer program instructions may also be stored in a computer-readable memory that can direct a computer or other programmable data processing apparatus to function in a particular manner, such that the instructions stored in the computer-readable memory produce an article of manufacture including instructions which implement the function/act specified in the block diagrams and/or flowchart
25 block or blocks.

The computer program instructions may also be loaded onto a computer or other programmable data processing apparatus to cause a series of operational steps to be performed on the computer or other programmable apparatus to produce a computer-implemented process such that the instructions which execute on the
30 computer or other programmable apparatus provide steps for implementing the functions/acts specified in the block diagrams and/or flowchart block or blocks.

It should also be noted that in some alternate implementations, the

functions/acts noted in the blocks may occur out of the order noted in the flowcharts. For example, two blocks shown in succession may in fact be executed substantially concurrently or the blocks may sometimes be executed in the reverse order, depending upon the functionality/acts involved.

5 Embodiments according to the present invention may provide a system to help objectify a decision making process. In some embodiments according to the present invention, an end-user may be able to objectively quantify each of the criteria of a decision making process, weight the importance of each factor, and rate each component of each solution to arrive at a final decision. Embodiments according to
10 the present invention may, therefore, allow a comparison of dissimilar criteria (*i.e.*, "apples to oranges") and would result in a decision that can reflect the strengths and weaknesses of each solution weighted toward the end-user's preferences.

 In some embodiments according to the present invention, a web-based decision making tool is used. Some embodiments according to the present invention
15 can allow prospective medical school residents to determine which potential training program most meets their needs. It will be understood that embodiments according to the present invention can be used in other areas outside medicine, such as professional training decision making, professional position matching, purchase decision making, end-user pharmaceutical choice, physician pharmaceutical prescribing, stock
20 comparisons, college application decisions, or the like. Embodiments according to the present invention can be used for other applications as well.

 Some embodiments according to the present invention can include: a web server, a database, and a web application. The web server portion can allow execution of the web application by: 1. creating a directory from which the web
25 application can be executed, *e.g.*, a "cgi-bin" directory, 2. installing the web application into the cgi-bin directory, and 3. configuring the web server to allow execution of the web application from the cgi-bin directory.

 In some embodiments according to the present invention, the database is an SQL (Structured Query Language) compliant database. Some embodiments
30 according to the present invention use a predetermined table structure, as shown for example, in Table 1. The database can allow data to be stored and queried independent of a user session and web application.

Table 1

Sequences:

dataid, data table unique identifier
critid, criteria table unique identifier
progid, program table unique identifier
axid, extremes table unique identifier

Tables:

users, CompMatrix users {
 uid, random and unique,
 username, login name,
 password, login secret,
 sessionid, see session table: id,
 critid, see critdata table: id,
 axid, see extremes table: id,
 critdisplay, criteria display preference,
 firstname, Christian name,
 lastname, surname,
 email, email address,
 phone, phone number,
 advisor, advisor name,
}

data, CompMatrix data {
 id, see dataid sequence,
 uid, see users table: uid,
 program, see program table: code,
 score, program score,
 critid, see critdata table: id,
 progid, see progdata table: id,
 display, matrix display preference,
 sysHide, saved data,
}

criteria, selection criteria {
 code, unique identifier,
 name, descriptive unique identifier,
 category, see categories table,
 alpha, start extreme,
 omega, end extreme,
}

programs, resident programs {
 code, unique identifier,
 name, descriptive unique identifier,
 city, location,
 state, location,
}

critdata, user criteria data {
 id, see critid sequence,
 (list: codes, see criteria table),
}

progdata, user program data {
 id, see progid sequence,
 (list: codes, see criteria table),
}

extremes, user extreme data {
 id, see axid sequence,
 (list: codes, see criteria table (constraint requires
alpha)),
}

categories, criteria categories {
 category, name of category,
}

session, user session data {
 id, random and unique,
 time, last user action,
}

suggest, user suggestions {
 time, time of submittal,
 suggest, suggestion text,
}

In some embodiments according to the present invention, a user logs in and is prompted to select a set of decision criteria. If a criterion has different possible interpretations (*e.g.*, does “distance from family” mean near to the family is more or less desirable) then the user is asked to select the appropriate interpretation for them. The user is asked to weight each of the criteria relative to one another allocating a total of 100 points between all of the criteria. If the weights don’t total to 100, then they may be automatically scaled to 100.

In some embodiments according to the present invention, the user selects a program (such as a residency program), and rates each of the previously selected criteria, for example, from zero to ten (ten being best). The product of the weighting and the rating can provide a score for the respective criteria. The scores for each criteria are summed to arrive at a score for the program. The program and program score (along with criteria selected, weights, and ratings) can be presented in a matrix ordered, for example, from best to worst.

An exemplary implementation illustrating embodiments according to the present invention is on the world-wide-web at anesthesia.mc.duke.edu/compmatrix, the entire contents of which are incorporated herein by reference.

In some embodiments according to the present invention, the web application is written in Python, an interpreted, object oriented programming language. Other languages can be used. In operation, the user input to the web application can instantiate an object. The instantiated object can have several associated properties, such as methods or actions that the object can take based on the user input, others can be variables, or pre-assigned values set in the object.

In some embodiments according to the present invention, the object instantiation can: 1. create object properties, such as variables and/or methods, 2. open a connection to the database, and 3. import user input data. The instantiated object can have a number of variables from the user input, either directly or through hidden fields. The web application can use the value of a “target” field to determine what method to call.

In some embodiments according to the present invention, if the target of the object is “Login” or “New Account” the object verifies that both the username and the

password field are filled in and that the username doesn't contain any characters other than "A-Za-zO-9.-_". If either of these checks fails then the object returns an explanation of the problem and redraws the login form. If the target is "Login" then the object calls a method to verify the username against the password and on success
5 updates the session table and marks the user as authenticated; on failure the object returns an explanation and redraws the login form. If the target is "New Account" then the object checks the username for uniqueness and confirms the password. Success updates the session table and marks the user as authenticated; failure returns an explanation and redraws the login form. Once the user has been marked as
10 authenticated every method called first checks this authentication.

Following authentication, new users step through a series of web forms created by the web application. Each of these introduces a "target" that the application then calls the method for. These methods in turn either return success, update the appropriate tables in the database, and call a method to draw the next
15 form, or return a failure and redraw the current form. Once the forms have been filled in correctly the application can display a matrix of programs and scores. In some embodiments according to the present invention, users who have previously setup an account can have their matrix displayed when they log in for subsequently sessions.

In some embodiments according to the present invention, the matrix screen is
20 a web form, which can allow for modification of program scores, selecting new criteria, changing the criteria weights, and rating new programs. Each of these can be called by the object instantiated when a form is submitted. Information stored in the database may be aggregated and analyzed to understand the needs and interests of the user pool as well as to compare and contrast each of the possible solutions.

25 Operations of embodiments according to the present invention, will be further described below in reference to the flowcharts of Figures 1-4 and the display screens of Figures 5-15. Referring to the numbered blocks in Figure 1, operations may be initiated as follows:

1. Start: User begins the application.
- 30 2. About: The user can choose to view a screen describing the program and how to use it (see Figure 5).
3. Login / New Account: The user is presented with a screen that asks for

username and password. After providing the information the user will then select either “login” or “new account” (see Figure 6).

4. Username / Password: The user inputs a username and password.
5. Login / New Account: The user chooses either “login” or “new account.”
- 5 6. Check Username: The application checks the user table in the database to see if this username is already in use.
7. Username Used: The username is in use and the user is asked for a username and password again (see Figure 7).
8. Confirm Password: The username was not in use so the user is asked to
10 confirm their password (see Figure 8).
9. Password: The user inputs the password.
10. Check Password; The application compares the password strings to verify that they are the same.
11. Passwords Don’t Match: The password strings don’t match so the user is
15 asked for a password and a confirmation password (see Figure 9).
12. Create Account: The application inserts the account details into the database user table.
13. Begin CompMatrix: (see Figures 2 and 3).
14. Stop.
- 20 15. Check Authentication: The application verifies the username from the database user table, encrypts the provided password string, and compares that with the stored password from the database user table.
16. Authentication Failed: Either the username didn’t exist or the password was incorrect so the user is asked for a username and password (see Figure 10).
- 25 17. Create Matrix: The application selects the user’s decision making criteria, weights for that criteria, program ratings for that criteria, and program scores from the database. It uses this information to create a Matrix of program scores.
Display Matrix: The application outputs the created display to the user (see
30 Figures 4 and 11).
CompMatrix Actions: (see Figure 4).
18. Stop.

In other embodiments according to the present invention, and referring to the numbered blocks of Figure 1, operations may begin as follows:

- 1.1 Start
- 5 1.2 Display: About the program (Figure 5)
- 1.3 Display: Login or New Account screen (Figure 6)
- 1.4 Input: Username and Password
- 1.5 Decision: Login or New Account
- 1.6 (New Account) Procedure: Check the database for whether this
- 10 Username is used already
- 1.7 (New Account) Display: Username is used; choose another (Figure 7)
- 1.8 (New Account) Display: Confirm password for new account (Figure 8)
- 1.9 (New Account) Input: Password, again
- 1.10 (New Account) Procedure: Check if passwords match
- 15 1.11 (New Account) Display: Passwords don't match; re-enter passwords (Figure 9)
- 1.12 (New Account) Procedure: Create account in database
- 1.13 (New Account) Extend: Continue the matrix process (Figures 2 and 3)
- 1.14 (New Account) Stop
- 20 1.15 (Login) Procedure: Check the database for the username and password
- 1.16 (Login) Display: Authentication failed; try again (Figure 10)
- 1.17 (Login) Extend: Display matrix (Figure 4, Figure 11)
- 1.18 (Login) Stop

- 25 Referring to Figure 2, some embodiments according to the present invention can operate as follows in reference to the numbered blocks of Figure 2:

- 2.1 Start
- 2.2 Procedure: Get criteria from the database
- 30 2.3 Display: Select criteria (Figure 11)
- 2.4 Input: User selected criteria
- 2.5 Procedure: Load user criteria into the database

- 2.6 Procedure: Check database for criteria endpoints
- 2.7 Decision: If endpoints exist, select them
- 2.8 (Endpoints) Display: Select endpoints (Figure 12)
- 2.9 (Endpoints) Input: Select endpoints
- 5 2.10 (Endpoints) Procedure: Load endpoints into database
- 2.11 Display: Select weights for criteria (Figure 13)
- 2.12 Input: User weights
- 2.13 Procedure: Load database with weights for criteria
- 2.14 Stop

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Referring to Figure 3, some embodiments according to the present invention can operate as follows in reference to the numbered blocks of Figure 3:

- 3.1 Start
- 3.2 Procedure: Get programs from the database
- 15 3.3 Procedure: Poll database for user criteria, endpoints, and weights
- 3.4 Display: Display programs and user data (Figure 14)
- 3.5 Input: User rating for a program
- 3.6 Procedure: Load rating into database
- 3.7 Procedure: Create matrix in database
- 20 3.8 Extend: Display Matrix (Figure 4)
- 3.9 Stop

Referring to Figure 4, some embodiments according to the present invention can operate as follows in reference to the numbered blocks of Figure 4:

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- 4.1 Start
- 4.2 Procedure: Poll database for matrix
- 4.3 Display: Display matrix (Figure 15)
- 4.4 Decision: Matrix actions
- 30 4.5 Procedure: Display all programs and ratings
- 4.6 Procedure: Turn off display per program
- 4.7 Extend: Re-select criteria (Figure 2)

4.8 Extend: Re-weight criteria (Figure 2, beginning at 11)

4.9 Extend: Rate new program (Figure 3)

4.10 Extend: Re-rate program (Figure 3, beginning at 3)

4.11 Stop

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Accordingly, some embodiments of the present invention provide computer-based decision making methods, systems and computer program products for selecting a choice from a plurality of choices. A set of criteria that pertain to the plurality of choices is displayed to a user. See, for example, Figure 2, Block 3; Figure 10 4, Block 7 and Figure 11. A user selection of at least a subset of the criteria is accepted. See, for example, Figure 2, Block 4; Figure 4, Block 7 and Figure 11. User input is accepted of weights for the criteria that were selected. See, for example, Figure 2, Blocks 11 and 12; Figure 4, Block 8 and Figure 13. User input is accepted of a numeric rating for the criteria that were selected for each of the plurality of 15 choices. See, for example, Figure 3, Blocks 4 and 5; Figure 4, Blocks 9 and 10, and Figure 14.

A score is then calculated for each choice by summing the products of the numeric rating and the weight for the criteria that were selected. See, for example, Figure 3, Block 7 and Figure 4, Block 4. At least one of the choices is then displayed 20 based on the scores that were calculated. See, for example, Figures 3, Block 8; Figure 4, Block 3, and Figure 15. In other embodiments, in order to accept user input of weights for the criteria that were selected, the user is displayed different interpretations that are selected criterion may have. See, for example, Figure 2, Blocks 7 and 8, and Figure 12). User input is then accepted as to a desired 25 interpretation for the selected criterion. See, for example, Figure 2, Block 9, and Figure 12. In other embodiments, the weights are scaled. See, for example, Figure 13. Moreover, as shown, for example, in Figure 11, the set of criteria may be arranged in groups of criteria. The ranking of the plurality of choices may be displayed based on the scores. The criteria, weights and scores may be analyzed for a 30 plurality of users.

In the drawings and specification, there have been disclosed embodiments of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation, the scope of the invention being set forth in the following claims.

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